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Distribution, eggs number and nutrition content of *pila scutata* snail in rice fields of Subak Uma Desa, Duda village-Bali

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Abstract
In the rice fields can be found several species of snails. One of them is *Pila scutata* which can be used as a source of protein. There is not much research on the snails, especially in rice fields in Bali. Research was conducted to determine the density, egg number, and nutritional content of the snail in rice fields of the subak Uma Desa, Duda Village, Karangasem Regency, Bali. Snail were collected from three plots of rice fields which already planted with rice plant. At each rice field plots are placed a quadrate made of pipes measuring 1 x 1 m, then the snails with all the sizes contained in the quadrate are taken. Sampling of snail eggs was also carried out in three rice fields where the snail samples were collected, namely by searching the entire area. Measurement of environmental factors were carried out every sampling. The samples of snails and their eggs were brought to the laboratory to be counted, observed for morphology and morphometry and counted the eggs in a eggs group. Furthermore, the snail samples were analyzed for their nutritional content. The results showed that the density of the snails was 4.67 ind/m^2, frequency of presence was absolute, and distribution pattern was regular. The snails was mostly found in sheltered places. Egg groups are white, found in sheltered areas and above the waterline. The protein content of the snails was 52.57%.

Keywords: Apple snails, mollusk, native species, rice field

Introduction
Freshwater molluscs have an important role in nature and help in assessing the ecological status of a waters [11]. *Pila scutata* belongs to the Mollusca phylum, is a species in the Ampullariidae family. According to [9], this family consists of nine extant genera and more than 150 recognized species of Pila, originating from Southeast Asia, one of which is *Pila scutata*. In [13], it is stated that the distribution of *Pila scutata* includes India, Malaysia, Myanmar; The Philippines, Singapore, Thailand and in Indonesia include Bali, Java, Kalimantan, Lesser Sunda.

Pila scutata is known as the gondang snail or small gondang. "Kakul" is the name for these snails, especially in the area of the island of Bali. Freshwater habitats with calm water flow are habitats favored by these snails, including ponds, lakes and rice fields [13]. Rice fields as an ecosystem, have a high diversity of animal groups, including animals that are native to the habitat of rice fields and some are deliberately introduced by humans for cultivation purposes. *Pila scutata* is one of the original inhabitants of the rice field habitat.

Pila snail habitat is often invaded by genus Pomacea snails. The snails has a high adaptability than Pila snails. Pomacea has an effect on the decline in the Pila snail population in the Southeast Asia region [9]. According to [15], although the *Pila scutata* species is widespread in Southeast Asia, in Indonesia its existence is currently rarely found due to pressure from the introduction of the golden apple snail (*Pomacea canaliculata*) [1]. Stated that the selective nature of the Pila snail for food was also the cause of the decline in its population.

Snails can be used for alternative proteins that are useful for humans or can be used as animal feed ingredients [6]. *Pila scutata* is one of the species commonly consumed by the community, mainly in Java and Sumatra [15]. In Bali. The community uses snails as an alternative protein source, including the gondang snail which is processed into a variety of dishes. The snalis also used for materials in religious ceremonies

Referring to the important role and benefits, the information of the gondang snail in rice fields

in Bali is needed because there is not much scientific data about these snails. Based on information from several farmers, these snails are rarely found in rice fields, so this research was carried out in one of the the traditional irrigation system (Subak) in Duda Village, namely in Uma Desa subak.

Research methods

Sampling method

The snail was collected in the rice fields in Bali, exactly in Subak Uma Desa, Duda Village (Fig. 1). Snail were collected from three plots of rice fields already planted with rice plant. Rice plant age less than one month. At each plots was placed a 1 x 1 m square made of pipe, then snails with all sizes contained in the square were taken. Samples were collected in the morning and repeated three times with an interval of one week. Snail egg samples were also collected in the three rice fields where the snails were collect. Then all the snail and egg samples were stored in a jar containing rice field water. Environmental factors are measured in situ every snail sampling.

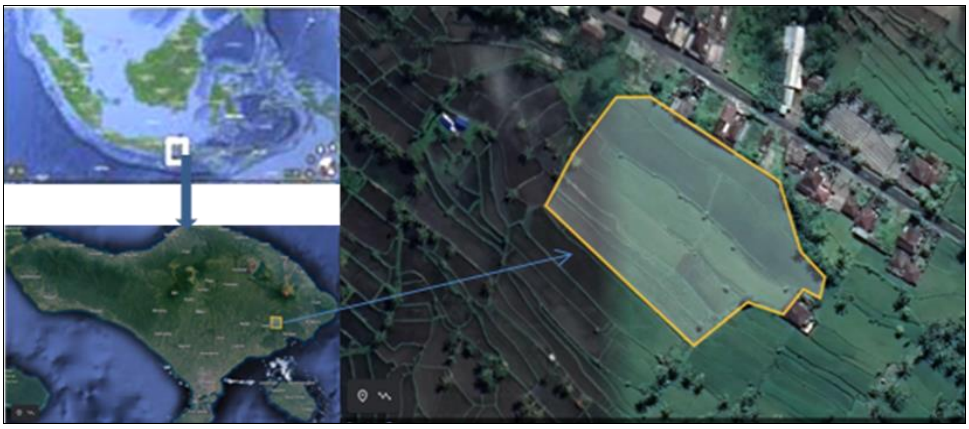

Fig 1: Sampling location of *Pila scutata* (Google map, 2022)

Observation of snail samples and groups of snail eggs at laboratory

Shell morphology and morphometry oh the snails was observed. Calipers are tools used to measure snail morphometry. Morphometry characters include: shell length and width, aperture length and width, number of shell turns, and body whorl length. The group of snail eggs was counted and each group of eggs was separated to count the number of eggs in one egg group.

Preparation of Snail Samples for Analysis of Nutrient Content

After observing the morphological and morphometric characters, the snail samples were processed into flour. The manufacture of snail flour refers to [3], namely by soaking the snails in a storage container within one day with the aim of reducing the feces. Next, the conch is boiled for 15 minutes and drained. The snail's body is separated from its shell, sliced into small pieces and then dried in the sun. The dried conch meat is ground into flour to be analyzed for its nutritional content.

Research variable

Density variables, frequency of presence, distribution pattern

These data were taken from all snail individuals and calculated with reference to [5]. Morphological and morphometric data were obtained from observations of the morphology and morphometry of the snail shells.

Egg group

Data was obtained from the number of egg group and then the number of eggs from each group was calculated.

Nutritional content

The nutritional content analyzed included water content, ash, fiber, protein, crude fat, carbohydrates, and calories, which was carried out according to the Standard Operation Procedure at the Integrated Service Laboratory, Faculty of Agricultural Technology, Universitas Udayana.

Data analysis

Data analysis was descriptive comparative and then presented in the form of tables and figures.

Results

The rice fields of Subak Uma Desa where the sample was taken are at an altitude of 528m-546m above sea level with 8'26'636'S and 115'29'310'E coordinates. The environmental factors measured are listed in Table 1. Density, frequency of presence, Morisita indeks are listed in Table 2.

Table 1: Environmental factors data

Parameter	Average
Dissolved oxygen/DO (mg/L)	7.10
Water pH	7.17
Water temperature (^{o}C)	23.33
Water depth (mm)	4.33
Air temperature (^{o}C)	20.67
Humidity (%)	91.47

Table 2: Density, frequency of presence, and Morisita index

Variable	Nilai	Criteria
Density (ind/m^2)	4,67	
Frequency of presence (%)	91,67	absolute
Morisita Index	0,97	regular

The snail shells found were sub-globose, the length of the shell was 17.02-40.04 mm and the width was 15.01-35.96 mm. *Pila scutata* snails have grouped eggs same as Pomacea snails eggs but *Pila scutata* snail eggs are white while Pomacea snail eggs are red. Eggs was mostly found in

sheltered places. Places where eggs were found include: under grass that grows in rice fields and rice fields embankments. The results of the *Pila scutata* snail egg research are presented Table 3.

Table 3: Data of *Pila scutata* eggs

Variable	Number
Egg group	4 - 11
Egg in one egg group	24 – 135

Pila scutata snails have a relatively good nutritional content, namely with a protein content of more than 50% (Table 4) so it is good to be used as an alternative protein source and local residents have used it.

Table 4: The average nutritional content of snails

Variable	Average
Water content (%)	12.58
Ash (%)	15.55
Fiber (%)	19.70
Protein (%)	52.57
Fat (%)	15.07
Carbohydrate (%)	4.23
Calory (Kkal)	362.84

Discussion

One of the environmental parameters affecting snail breeding is water quality [2]. According to [11], water temperature is a factor that affects the distribution of gastropods. The water temperature measured at the research site is included in the temperature that supports snail life and the pH of the water tends to be alkaline which also supports snail growth. According to [4], alkaline pH is more favorable for snail growth.

The density of snails found was 4.67 individuals/m^2 (Table 2). When compared with its relative (golden apple snail), based on the results of research by [16], the density of the golden apple snail in a rice field area can reach 10.42 individuals/m^2. The density of the *Pila scutata* snail is smaller than the golden apple snail density. The results of the frequency of presence including the absolute criteria because in the range of 75-100%. The value of the frequency of presence of the snails were 91.67%. Frequency of presence is a value that states the presence of a species in a habitat so that it can describe how often the species can be found. Based on the results, the most of snails were found in 12 square made at the time of sampling.

According to [9], Pila snails usually inhabit shallow water habitats among vegetation in freshwater marshes, lakes, ponds, as well as in ditches or runoff with moderate flow; and likes the edge of nature which is shady and protected. In this study, snails were more commonly found in protected rice fields, including near rice plants, under grass and attached to basins at the edges of rice fields.

The characteristics of the snail shells found were sub-globose, yellowish green and greenish-brown in color, some shells were plain and some with irregular brown spiral lines or bands, smooth shell surface, high shell crest; round body circle; the umbilicus is small and hidden. The shell character is in accordance with the character proposed by [9].

The morphometric character of the snail showed that the length of the shell was 17.02-40.04 mm and the width was 15.01-35.96 mm. [9] stated that the length of the snail shell could reach 50 mm while [15] stated that the length of the snail shell is 33.54-51.26 mm; width 28.02-44.30 mm.

Snail egg group were generally found in basins around rice fields and in protected areas under vegetation. This was in accordance with [14]. The results of counting the number of eggs in each egg group, found 24-135 eggs (Table 3). This result shows a higher number than the results of [7] who found 8 -20 eggs in one egg group.

The content of these nutrients can vary in different environments because it is influenced by several factors. [10] stated that species, size (age), level of sexual maturity, temperature, food, and habitat affect the variability of the nutritional content of gastropod meat. [8]. Stated that the individual physiological status of mollusk species depends on food, physio-chemistry, water factors, and habitat.

Conclusion

Pila scutata snail density was 4.67 ind/m^2. Frequency of presence was absolute and distribution pattern was regular. The snails were found in sheltered places. The shell height ranges from 17.02-40.04 mm and a width of 15.01-35.96 mm. Groups of eggs are white with 24-135 eggs in one egg group. The snail has a good nutritional content with a protein content of more than 50%.

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